Problem Definition

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The first activity of the method framework is Explicate Problem. The goal of this activity is to formulate the initial problem precisely, justify its importance, and investigate its underlying causes. In other words, it addresses the question: What is the problem experienced by some stakeholders of a practice and why is it important?

The answer to this question consists primarily of descriptive knowledge about the characteristics and the environment of the problem. Sometimes, the answer will also include explanatory knowledge about the causes of the problem.
A problem is an undesirable state of affairs or, more precisely, a gap between a desirable state and the current state. For example, suppose that several customers of a car retailer complain about the long delivery times for cars. The customers expect the time from order placement to product delivery to be less than 1 week (desirable state), instead of the current 3 weeks (current state). Thus, this is the gap that constitutes the problem.
The gap between the desirable and the current state is not always made explicit when a problem is discussed. Often, the gap is so obvious that knowledge of the current state is sufficient to conclude that a problem exists. For example, if many customers of the car retailer complain about delivery times for cars, its management will realize that customers are dissatisfied and that there exists a problem to be addressed.

In other cases, a problem may become apparent only when someone suggests a more desirable state of affairs. For example, suppose that no customer has complained about the delivery times, but a competitor states in a marketing campaign that its delivery time of cars is only 3 days from order placement. If the management interprets this as a threat, there will be a problem, although the current state was not viewed as undesirable in itself.
Not only threats but also opportunities can be viewed as problems. An example is an organization that receives information from its ERP vendor that mobile devices can be integrated with its ERP system. Thereby, the employees can access the system from anywhere, which might increase their productivity. Therefore, the problem is that currently the organization does not work as productively as possible, because its employees do not benefit from this opportunity of mobile technology.

(*) Note: Enterprise resource planning (ERP) is business process management software that allows an organization to use a system of integrated applications to manage the business and automate many back office functions related to technology, services and human resources.
The two problems above are situated in local practices. Therefore, they need to be generalized in order to work as problems in design science research. At some stage in the research, the problems need to be transformed into generic problems that are relevant for a global practice, such as “customers often complain over long delivery times among car retailers” and “organizations experience productivity loss because mobile devices are not integrated with their ERP systems”.

**Generalizing the Problem**

- The two problems mentioned previously above are situated in local practices.
- The problems need to be generalized / transformed into generic problems that are relevant for a global practice.

**Example:**
- Customers often complain over long delivery times among car retailers
- Organizations experience productivity loss because mobile devices are not integrated with their ERP systems
Explicate – Definition

• Meaning
  • Analyze and develop (an idea or principle) in detail.
    • "attempting to explicate the relationship between crime and economic forces"
  • Analyze (a literary work) in order to reveal its meaning

• Origin
  • from Latin explicat- ‘unfolded’,
  • from the verb explicare, from ex- ‘out’ + plicare ‘to fold’.
The activity Explicate Problem can be structured and visualized as in Fig. 5.1. The input is an initial problem that can be vaguely formulated. The output is an explicated problem, which is precisely defined, well justified, and put into a context. The resources used by the activity consist of knowledge in the research literature and other written sources, as well as information from relevant stakeholders. The controls are primarily research strategies and methods but may also include other practice-based approaches to problem elicitation and representation.
Explicate Problem - Define Precisely

Initial problem -> Explicate Problem

- Define Precisely
- Position and Justify
- Find Root Causes

Research strategies
Research methods
Practice-based approaches

Previous research
Stakeholder interests
and views

Explicated problem
A problem should be defined as precisely as possible so that different people understand it in the same way. A problem definition is made more precise by reducing the number of ways in which it can be understood and interpreted. For example, a problem definition such as “patient care provided by multiple care providers is often of low quality” is vague and may be interpreted in many different ways. The background to this problem is that, today, it is common that patients are treated by multiple care providers because of specialization of care providers, including specialist and general practitioners. The problem can be made more precise by being reformulated as “patient care provided by multiple care providers poses risks for patient safety”. The second formulation is narrower and has fewer possible interpretations than the first one. This is only one way of making the original problem more precise; another reformulation could focus on patient experiences, “patient care provided by multiple care providers is inconvenient for the patients”.

In general, precise problem definitions are to be preferred over less precise ones, as they help people to develop a common view of a problem. Furthermore, a precise problem definition helps to limit the scope of the research project, thereby increasing the chances for success. However, highly precise problem definitions can sometimes be difficult to quickly grasp and understand. There is also a risk that in the process of formulating a more precise problem definition, it becomes too narrow, and important aspects are omitted. An overly narrow problem formulation
may also exclude potentially innovative solutions.
In general, precise problem definitions are to be preferred over less precise ones, as they help people to develop a common view of a problem. Furthermore, a precise problem definition helps to limit the scope of the research project, thereby increasing the chances for success. However, highly precise problem definitions can sometimes be difficult to quickly grasp and understand. There is also a risk that in the process of formulating a more precise problem definition, it becomes too narrow, and important aspects are omitted. An overly narrow problem formulation may also exclude potentially innovative solutions.
In order to define the problem more precisely, different groups of stakeholders can be approached, e.g. managers, employees, and customers, as they may have different views and knowledge about various aspects of the problem. By combining contributions from different stakeholder groups, the researcher can achieve a deeper and more complete explication of the problem. Soft systems methodology, a method for systems development, emphasizes the need to involve different groups of employees in a problem analysis. Different groups often have different views on the problem and therefore have different expectations on the solution to be designed and developed. If the designers do not acknowledge this, there is a risk that a systems development project fails. For example, the designers of the system can be unaware that strong groups in the organization work behind the scenes to obstruct the implementation of the solution. In order to recognize the needs and interests of different groups, a problem definition can preferably be left somewhat vague but complemented with a number of more detailed problem definitions, each related to a certain group’s view of the problem. This could be one way to manage the complexity of socio-technical systems, where artefacts will be deeply embedded in a complex environment that includes humans and their social relationships.
Explicate Problem – Position & Justify

Research strategies
Research methods
Practice-based approaches

Initial problem

Explicate Problem

Define Precisely
Position and Justify
Find Root Causes

Previous research
Stakeholder interests and views

Explicated problem
When a problem is formulated in isolation, it is often difficult to understand, communicate, and justify. Therefore, it is helpful to put the problem into a context, which can be done by positioning it in the practice within which it occurs, i.e. describe the purpose, stakeholders, activities, and environment of the practice. A problem should always be well justified so that people can agree that it is worthwhile to address it. The problem should be significant for its practice, i.e. viewed as important by stakeholders who want to find a solution to it. Furthermore, the problem should be of general interest, i.e. it should not matter only to a single local practice. The problem should also be challenging, in the sense that a solution to it does not already exist. Sometimes a problem can be original, which is particularly common when technological innovations have created new opportunities. The justification of a problem may also include its ethical and societal consequences.
Explicate Problem – Find Root Causes

Research strategies
Research methods
Practice-based approaches

Initial problem

Explicate Problem

Define Precisely
Position and Justify

Find Root Causes

Previous research
Stakeholder interests
and views

Explicated problem
At an early stage, a problem is often formulated in an impressionistic way, mainly expressing a feeling that some state of affairs is unsatisfactory. However, in order to do something about the problem, it is not sufficient to stay with such an impressionistic understanding. A more detailed understanding is required. In order to arrive at this, a so-called root cause analysis can be performed, in which the underlying causes are identified, analysed, and represented. By addressing these causes, better results can be achieved than by treating only the symptoms of the problem. For example, an initial problem may be expressed as “patient care provided by multiple care providers poses risks for patient safety”. The underlying causes of this problem can be of different kinds, including information deficiencies, lack of competence, inadequate incentives, and unclear responsibility structures. Focusing on information deficiencies, three underlying problem causes are:
- Different care providers lack information about other providers’ performed, ongoing, and planned activities.
- Different care providers do not have knowledge and shared understanding about the problem and status of the patients.
- Different care providers do not have knowledge and shared understanding about the care goals of the patients.

One widespread tool for representing problem causes is the Ishikawa diagram (also called cause-effect diagram or fishbone diagram); see Fig. 5.2 for an example.
An Ishikawa diagram is a graphical tool used to investigate and represent potential causes of a problem. It consists of a main horizontal line representing the problem and associated slanting lines representing direct problem causes, which in turn may be related to additional lines representing indirect problem causes. The causes can also be classified into different categories, as indicated in Fig. 5.2.
Find Root Causes – Example - Patient care

- **Initial Problem Definition**: Patient care provided by multiple care providers poses risks for patient safety

- **Root Causes**
  - Information deficiencies
  - Lack of competence
  - Inadequate Incentives
  - Unclear responsibility structures

- **Redefinition of the Problem based on Root Cause** - Focusing on information deficiencies - three underlying problem causes are:
  - Different care providers lack information about other providers’ performed, ongoing, and planned activities.
  - Different care providers do not have knowledge and shared understanding about the problem and status of the patients
  - Different care providers do not have knowledge and shared understanding about the care goals of the patients.
Kaoru Ishikawa (石川馨, Ishikawa Kaoru, July 13, 1915 – April 16, 1989) was a Japanese organizational theorist, Professor at the Faculty of Engineering at The University of Tokyo, noted for his quality management innovations. He is considered a key figure in the development of quality initiatives in Japan, particularly the quality circle. He is best known outside Japan for the Ishikawa or cause and effect diagram (also known as fishbone diagram) often used in the analysis of industrial processes.

A quality circle or quality control circle is a group of workers who do the same or similar work, who meet regularly to identify, analyze and solve work-related problems. It consists of minimum three and maximum twelve members in number. Normally small in size, the group is usually led by a supervisor or manager and presents its solutions to management; where possible, workers implement the solutions themselves in order to improve the performance of the organization and motivate employees. Quality circles were at their most popular during the 1980s, but continue to exist in the form of Kaizen groups and similar worker participation schemes.

Typical topics for the attention of quality circles are improving occupational safety and health, improving product design, and improvement in the workplace and manufacturing processes. The term quality circles was most accessibly defined by Professor Kaoru Ishikawa in his 1988 handbook, "What is Total Quality Control? The Japanese Way" and
circulated throughout Japanese industry by the Union of Japanese Scientists and Engineers in 1960.
Ishikawa Diagram

Cause-Effect Diagram or Fishbone Diagram
The *defect* is shown as the fish's head, facing to the right, with the *causes* extending to the left as fishbones; the ribs branch off the backbone for major causes, with sub-branches for root-causes, to as many levels as required.

Ishikawa diagrams were popularized in the 1960s by Kaoru Ishikawa, who pioneered quality management processes in the Kawasaki shipyards, and in the process became one of the founding fathers of modern management.

The basic concept was first used in the 1920s, and is considered one of the seven basic tools of quality control. It is known as a fishbone diagram because of its shape, similar to the side view of a fish skeleton.

*Mazda Motors* famously used an Ishikawa diagram in the development of the *Miata (MX5)* sports car.
Root-cause analysis is intended to reveal key relationships among various variables, and the possible causes provide additional insight into process behavior. Each potential cause is traced back to find the root cause, often using the 5 Whys technique. Typical categories include:

- **The 5 Ms / 8Ms (used in manufacturing)**
  - Man / mind power (physical or knowledge work)
  - Machine (equipment, technology)
  - Material (includes raw material, consumables, and information)
  - Method (process)
  - Measurement / medium (inspection, environment)

- These have been expanded by some to include an additional three, and are referred to as the 8 Ms:
  - Mission / mother nature (purpose, environment)
  - Management / money power (leadership)
  - Maintenance
Find Root Causes – Root Cause Analysis
Cause-Effect Diagram or Fishbone Diagram

- **The 8 Ps (used in product marketing)** - This common model for identifying crucial attributes for planning in product marketing is often also used in root-cause analysis as categories for the Ishikawa diagram:
  - Product (or service)
  - Price
  - Place
  - Promotion
  - People (personnel)
  - Process
  - Physical evidence
  - Performance

- **The 4 Ss (used in service industries)** - An alternative used for service industries, uses four categories of possible cause:
  - Surroundings
  - Suppliers
  - Systems
  - Skill
An Ishikawa diagram is a graphical tool used to investigate and represent potential causes of a problem. It consists of a main horizontal line representing the problem and associated slanting lines representing direct problem causes, which in turn may be related to additional lines representing indirect problem causes. The causes can also be classified into different categories.

A fishbone diagram aims to break down and organize the Causes of an issue to reveal what elements have the greatest impact. Grouping the “causes” means you can think about the different elements of the problem as separate from the overall process. One or two of these “causes” will have a greater effect than the others and will guide you to the root of the problem. This structure also allows you to tackle smaller chunks which have a large impact on the problem. Looking at elements of the problem and not the whole process will likely make finding your solution less daunting and problem solving more manageable. After you have determined your root cause, prioritise or screen the causes to determine which are having the largest effect. Once identified focus on these. An easy Cause screening method involves looking at each one and asking two questions:

How likely is this cause to be the major source of the issue or variation?
- V - Very Likely
- S - Somewhat Likely
- N - Not Likely

How easy would it be to fix or control?
- V - Very Easy
- S - Somewhat Easy
- N - Not Easy

Put the answers to the two questions together. Work on the Causes that have a result of VV, VS, and SV.
How easy would it be to fix or control?
V - Very Easy
S - Somewhat Easy
N - Not Easy
Put the answers of the two questions together. Work on the Causes that have a result of VV, VS, and SV.
Explicate Problem – Resources

- Research strategies
- Research methods
- Practice-based approaches

Initial problem → Explicate Problem

- Define Precisely
- Position and Justify
- Find Root Causes

Explicated problem

Resources
- Previous research
- Stakeholder interests and views
Resources for Explicate Problem

- **Previous Research** - Researchers need to investigate previous research that has addressed similar problems and existing solutions.
- **Stakeholders Opinions** - Stakeholders in the practices may express views and opinions about a problem themselves, which then are to be interpreted by the researchers.
- **Observations** - Researchers can also gain a better understanding of the practices by observing participants in their daily activities.

The results of the activity Explicate Problem should be based on, and compared with, existing related work in order to ensure well-founded and original results. Therefore, researchers need to investigate previous research that has addressed similar problems and existing solutions. Not only research literature can be used but also other sources, e.g. newspaper articles and white papers.

In some cases, researchers can base the explication of a problem solely on the literature, but usually they also need to directly study participants and stakeholders of relevant practices. Stakeholders in the practices may express views and opinions about a problem themselves, which then are to be interpreted by the researchers. They can also gain a better understanding of the practices by observing participants in their daily activities.
Explicate Problem – Strategies and Methods

Strategy & Methods
- Research strategies
- Research methods
- Practice-based approaches

Explicate Problem
- Define Precisely
- Position and Justify
- Find Root Causes

Initial problem

Previous research
- Stakeholder interests
- and views

Explicated problem
Strategies and Methods

1. Surveys
2. Case Studies
3. Action Research
4. Grounded Theory
5. Ethnography
6. Interviews
7. Focus Groups
8. Questionnaires
9. Observation
10. Documents
In research of human subjects, a survey is a list of questions aimed at extracting specific data from a particular group of people. Surveys may be conducted by phone, mail, via the internet, and sometimes face-to-face on busy street corners or in malls. Surveys are used to increase knowledge in fields such as social research and demography. Survey research is often used to assess thoughts, opinions, and feelings.[1] Surveys can be specific and limited, or they can have more global, widespread goals. Psychologists and sociologists often use surveys to analyze behavior, while it is also used to meet the more pragmatic needs of the media, such as, in evaluating political candidates, public health officials, professional organizations, and advertising and marketing directors. A survey consists of a predetermined set of questions that is given to a sample.[1] With a representative sample, that is, one that is representative of the larger population of interest, one can describe the attitudes of the population from which the sample was drawn. Further, one can compare the attitudes of different populations as well as look for changes in attitudes over time. A good sample selection is key as it allows one to generalize the findings from the sample to the population, which is the whole purpose of survey research.

Surveys can be used for eliciting problem statements from a large group of stakeholders. Thereby, they provide an overview of the problems experienced
by, for example, managers, employees, end users, and customers. In many cases, different stakeholders have different views of the problem at hand, and a survey can make these differences explicit. However, a survey is usually an ineffective instrument for eliciting a deep and elaborated analysis of a problem from stakeholders.
Survey
Better User Research Through Surveys
Case Studies

Case studies can provide a deep understanding of the practice in which an initial problem emerged. This establishes a firm grasp of the root causes of the problem, as well as the stakeholders’ views on the problem. However, case studies are complex undertakings that rely heavily on the skills and experiences of the researchers performing them. This dependency on the individual researchers may be a drawback, as they may have interests and preconceptions that can bias the research work.
Strategies and Methods – Action Research (3/10)

- **Action Research (Definition)** - Action research is an interactive inquiry process that balances problem-solving actions implemented in a collaborative context with data-driven collaborative analysis or research to understand underlying causes enabling future predictions about personal and organizational change.

- **Advantages**
  - **Engaging Research** - Action research requires the active engagement of both researchers and practitioners in a practice.
  - **The Researcher Provides Fresh Perspective to Stakeholders** - The competence and experiences of the researchers may offer fresh perspectives on the problem that are not obvious to the stakeholders of the practice.
  - **Identify New Problems** - Furthermore, new and more important problems can emerge when the researchers are investigating opportunities and solutions with the stakeholders.

- **Disadvantages**
  - **Dependency on Researchers** - The dependency on the researchers is strong due to their active participation in the practice. Therefore, there is a risk that their interests and preconceptions will have too much influence on the problem explication.
  - **Participant Lack of Time** - A risk that the practitioners do not have the necessary time to be active in the research project.
  - **Lack of Collaboration** - A risk that the collaboration between researchers and practitioners does not work as expected.

Action Research Action research requires the active engagement of both researchers and practitioners in a practice. The competence and experiences of the researchers may offer fresh perspectives on the problem that are not obvious to the stakeholders of the practice. Furthermore, new and more important problems can emerge when the researchers are investigating opportunities and solutions with the stakeholders. However, the dependency on the researchers is strong due to their active participation in the practice. Therefore, there is a risk that their interests and preconceptions will have too much influence on the problem explication. There is also a risk that the practitioners do not have the necessary time to be active in the research project or that the collaboration between researchers and practitioners does not work as expected.
Grounded Theory
 Grounded theory is a research strategy in which pure empirical facts have a strong impact on the explication of a problem. The researchers start by gathering facts about the domain under consideration. Based on these facts, they suggest a first problem explication, which is tested against further empirical facts from the domain, resulting in a refined problem explication. The iterations between fact gathering and problem explication refinement continue until further empirical facts have no effect on the problem explication.

Advantages
- **Objective/Experimental**: It is not restricted by any specific theoretical view that may limit the researchers.

Disadvantage
- **Theoretical Bias**: As a theoretical lens can support the researchers in finding new perspectives on the problem.
Ethnography The research strategy ethnography allows researchers to understand the culture of a practice in depth. Thereby, they are able to see a problem not only as outsiders but also from the stakeholders’ point of view. Furthermore, based on their competence and experience, the researchers may understand the structures behind the stakeholders’ views and actions, which they themselves might not recognize. This knowledge can allow the researchers to arrive at a deep and rich explication of a problem. However, because ethnographical studies are time-consuming, they may only be able to understand a limited number of stakeholders, while other stakeholders may not be considered. The outcome of this research strategy also relies heavily on the competence and experience of the researchers.
Interviews allow a researcher to engage in a dialogue with a respondent in order to explicate a problem in an interactive and creative way. This is possible because the researcher, based on the respondent’s initial answers, can ask follow-up questions. A drawback of interviews is the dependency on the perspective and interests of the respondent, but this problem can be mitigated by interviewing several respondents. Another disadvantage is that the researcher’s personal attributes can affect the outcome of an interview.
Focus Groups A focus group is a research method in which several respondents in conversations may inspire each other to identify and define problems in a domain. However, there is a risk that dominant individuals in such a group have too great an impact so that other opinions are not voiced. To some extent, this problem can be handled by a skilful moderator.
Questionnaires

A questionnaire is a form that contains predefined written questions. An important benefit of using questionnaires for data collection is that they can be distributed to a large number of respondents easily and with low cost. A drawback is that a researcher and a respondent cannot discuss a problem situation informally and creatively. Therefore, the answers can be superficial. There is no time or inclination to provide detailed answers to the questions. Another drawback is that respondents can interpret the written questions of a questionnaire in different ways. Moreover, if the questions in the questionnaire are closed, i.e. the questionnaire have predefined answer options, there is also a risk that the respondents’ answers will be biased to the views of the researchers, since the researchers have decided the available answer options.
Observation In an observation study, researchers can observe the behaviour of people in a practice. A benefit of the method is that researchers, based on their competence and experience, can identify problems and circumstances that are not apparent to the people under observation. A drawback is that the method requires highly skilled researchers to interpret the actions and interactions of the people investigated. There is also a risk that the interests and preconceptions of the researchers may influence their interpretations in undesirable ways.
Observation
Selective Attention Test
The Monkey Business Illusion

Selective Attention Test
Documents A document study is a form of observation study, but the focus is on written documents, not actions. Written documents can expose contradictions in a practice and, therefore, be a valuable source for identifying and defining problems. However, the method requires skilled researchers for the interpretation of the documents. There is also a risk that some documents only show the official view of some actor and may hide existing problems.
Guidelines for Explicate Problem – Summary

• **Position the Problem** - Clarify in which practice the problem appears.
• **Formulate the Problem Precisely** - Describe the problem in a precise but also concise, easily understandable manner.
• **Justify the Problem** - Explain why the problem is important and to whom.
• **Ensure the Problem Is of General Interest** - Make clear that the problem is of interest not only to a local practice.
• **Ensure the Problem Is Solvable** - Define and analyze the problem so that it becomes small enough to be solved.
• **Specify the Sources of the Problem** - Describe the literature and the stakeholders that have previously identified, studied, and experienced the problem.
• **Describe How the Problem Has Been Explicated** - Explain what has been done to explicate the problem, in particular, how the stakeholders have been involved and how the research literature has been reviewed.
References

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• Videos
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